

Colloid Mobilization and Transport during Capillary Fringe Fluctuations

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Capillary fringe fluctuations due to changing water tables lead to displacement of air-water interfaces in soils and sediments. These moving air-water interfaces can mobilize colloids. We visualized colloids interacting with moving air-water interfaces during capillary fringe fluctuations by confocal microscopy. We simulated capillary fringe fluctuations in a glass-bead filled column. Confocal images showed that the capillary fringe fluctuations affect colloid transport behavior. Hydrophilic negatively-charged colloids initially suspended in the aqueous phase were deposited at the solid-water interface after a drainage passage, but then were removed by subsequent capillary fringe fluctuations. The colloids that were initially attached to the wet or dry glass bead surface were detached by moving air-water interfaces in the capillary fringe. Hydrophilic negatively-charged colloids did not attach to static air-bubbles, but hydrophobic negatively-charged and hydrophilic positively-charged colloids did.